[redacted] 12:51 9144712[redacted] GEORGE U. SHUE [redacted] RECEIVED

Exhibit I

TSMC INVENTION DISCLOSURE PAGE 1 OF 3 TSMC CONFIDENTIAL (WHEN COMPLETED)

FULL NAME(S) OF INVENTOR(S)	EMPLOYEE NO.	DEPARTMENT	TEL. NO.
S. L. Shue	955606	RD	3475
		233	

FOR USE BY INTELLECTUAL PROPERTY LAW
DISCLOSURE NO. TSMC-S-97-S042
WHERE & WHEN RECEIVED: TAIPEI, FAMILY, U.S.A.
12/5 - '97

TITLE OF INVENTION --
A Novel Planarization Method of Copper Damascene

BACKGROUND INFORMATION -- CURRENT PRACTICE AND DISADVANTAGES
Copper damascene wiring is one of the most promising technologies to reduce the RC delay as well as to perform the shrinkage of interconnect structures. Metal filling into not only submicron trenches but also submicron holes is the key for damascene wiring. To realize the Cu-damascene wiring, new technologies with excellent step coverage such as MOCVD and electroplating deposition have been studied. After Cu deposition, the polishing process is required to remove only top of the surfaces, and not to encroach on the trench for patterned sample.
There are several typical issues which have to be solved before the damascene can be widely used. Fig. 3 illustrates typical problems for the planarization damascene using CMP techniques. There are residual metal on the larger open area and dishing in the wide field regions of the patterns

MAIN POINTS OF CLAIM (PLEASE LIST ITEM BY ITEM)
1. Reduction of nonuniformity of Cu CMP by reverse tone trench photo on large open area;
2. Using electropolishing method to remove Cu from large open area;
3. Apply to other damascene such as Au, Al, etc.

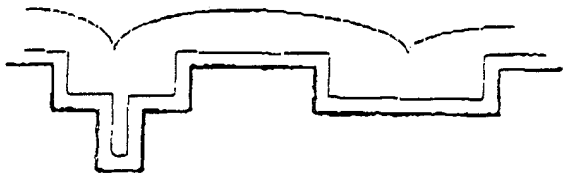
PROBLEM SOLVED OR IMPROVEMENTS OBTAINED BY THIS INVENTION (PLEASE LIST ITEM BY ITEM)
1. Reduction of nonuniformity on the wafer surface;
2. Improve the recess after Cu CMP;
3. Reduce the oxide erosion after damascene CMP process;
4. Release the grouping of pattern density issue;

KEYWORD SEARCH FOR PATENT/LITERATURES
Damascene, electroplating, electropolishing, CMP

PATENT/LITERATURES SEARCH RESULT (PLEASE SPECIFY SIMILAR PATENT NO. AND LITERATURE CITATION)
Literature:
Y.M. Dubin, et al, VMIC '97, p.69

DETAILED DESCRIPTION OF INVENTION -- (CONTINUED NEXT PAGE)

The process flow of this novel process is listed as following:
1. Dual Damascene Patterning
2. Barrier Metal Deposition
3. Seed Layer Deposition
4. Copper Electroplating
5. Reverse Tone Photo for Large Area
6. Electroplating by reverse current
7. PR stripping
8. Cu/Barrier layer CMP
9. Cap Layer



Disclosure No : 1-97-S042
Inventor Name : S.L.Shue
Title : A NOVEL PLANARIZATION METHOD OF COPPER DAMASCENE
Comment : (GS)

UNDERSTAND THIS ENTIRE INVENTION DISCLOSURE.

SIGNATURE OF WITNESS 陶宗遠 DATE [redacted]

SIGNATURE OF WITNESS 楊瑞枝 DATE [redacted]

DATE [redacted]

INVENTOR'S SIGNATURE
DATE

INVENTOR'S SIGNATURE
DATE

INVENTOR'S SIGNATURE
DATE

BEST AVAILABLE COPY

TSMC INVENTION DISCLOSURE — PAGE 3 OF 3 — TSMC CONFIDENTIAL (WHEN COMPLETED)

DETAILED DESCRIPTION OF INVENTION -- CONTINUED

FOR USE BY INTELLECTUAL LAW DISCLOSURE NO.

(A-2). Eelctropolishing by reverse current

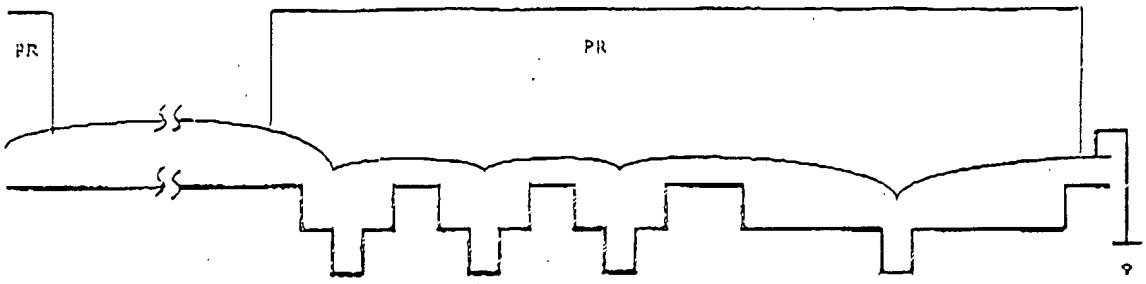


Fig. 5

(A-3). PR Striping

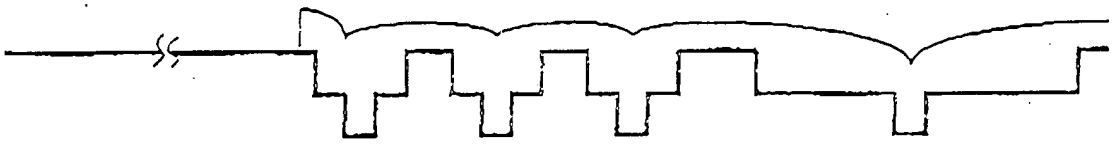


Fig. 6

(B). During CMP

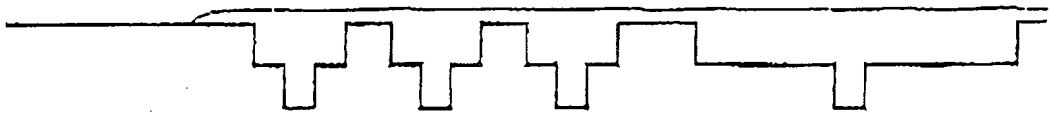


Fig. 7

(C). After CMP

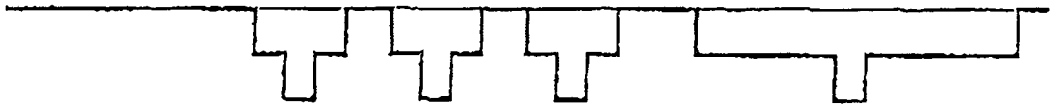


Fig. 8

WITNESSES: THE TWO WITNESSES WHOSE SIGNATURES APPEAR BELOW HAVE READ AND UNDERSTAND THIS ENTIRE INVENTION DISCLOSURE.

SIGNATURE OF WITNESS — DATE

[redacted]

SIGNATURE OF WITNESS — DATE

DISCLOSURE SUBMITTED BY

INVENTOR'S SIGNATURE
DATE [redacted]

INVENTOR'S SIGNATURE
DATE

INVENTOR'S SIGNATURE
DATE

INVENTOR'S SIGNATURE
DATE

TSMC INVENTION DISCLOSURE PAGE 2 OF 3 TSMC CONFIDENTIAL (WHEN COMPLETED)

DETAILED DESCRIPTION OF INVENTION -- CONTINUED

FOR USE BY INTELLECTUAL LAW
DISCLOSURE NO.

Conventional Method

(A). Before CMP

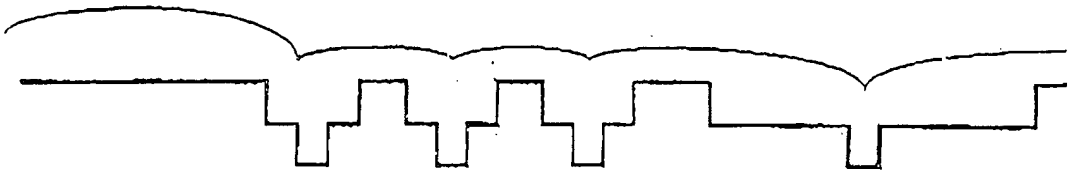


Fig. 1

(B). During CMP

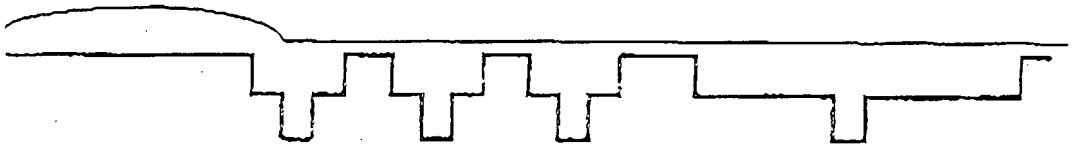


Fig. 2

(C). After CMP

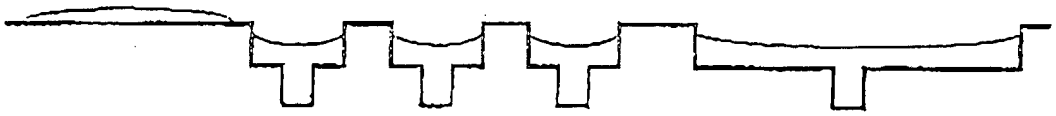


Fig. 3

Novel Method

(A-1). Reverse Tone Photo for Larger Area

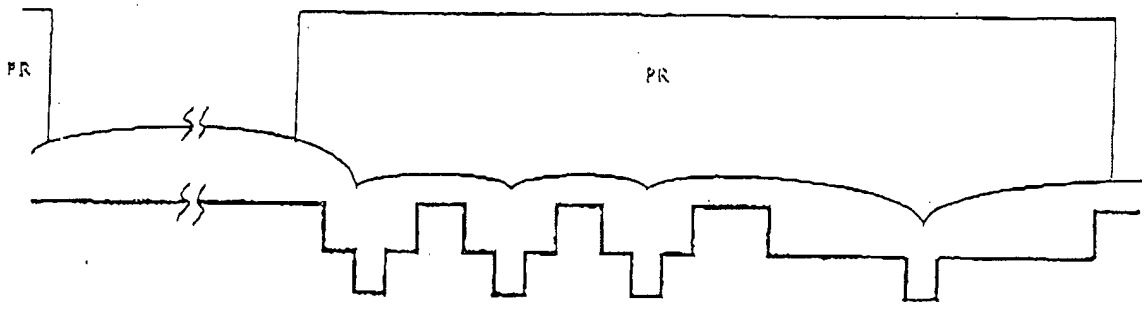


Fig. 4

WITNESSES: THE TWO WITNESSES WHOSE SIGNATURES APPEAR BELOW HAVE READ AND UNDERSTAND THIS ENTIRE INVENTION DISCLOSURE.

SIGNATURE OF WITNESS DATE

陶宏遠 [redacted]

SIGNATURE OF WITNESS DATE

DISCLOSURE SUBMITTED BY

INVENTOR'S SIGNATURE
DATE [redacted]

INVENTOR'S SIGNATURE
DATE

INVENTOR'S SIGNATURE
DATE

INVENTOR'S SIGNATURE
DATE

Exhibit 2

To : George O. Saile
Fm : TSMC / Patent Affairs

Subj : Comments of the Invention Disclosures

Disclosure No : 1-98-021
Inventor Name : S.M.Jang
Title : METHOD OF FORMING Al OR Cu DAMASCENE STRUCTURE.
Comment : (GS)1.COMBINE THIS PATENT APPLICATION IN TSMC97-542 2.FULLY REVERSE-TONE IS NOT NECESSARY FOR PRACTICAL USE. RELAXED REVERSE-TONE IS MORE PRACTICAL(SEE THE PRESENT MATERIAL) 3.MERGED INTO TSMC97-542 4.FILING AS SOON AS POSSIBLE.

-- the end --